

# Investigation of the Effect of Aluminum Alloy Position on Residual Stresses in Dissimilar FSW Weld by Using the Ultrasonic Method

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**Abstract:** The main goal of this study is to show the effect of the advancing side (AD) and the retreating side (RT) position on the Residual stresses and local mechanical behaviour of dissimilar friction stir welds of aluminum alloys AA2024-T3 and AA7075-T6. Different samples were produced by varying the rotational speed of the tool (1200 and 1400 rpm) and the alloy position regarding the advancing side of the tool. Ultrasonic Method has been used to evaluate Residual Stresses. This method is based on the acoustoelastic effect, which measures the velocity variation of the elastic waves according to the stress state of the material. This can be achieved through a calibration test, which permits the determination of the acoustoelastic coefficient (K). The results show a tensile stress in the Nugget (N), the heat affected zone (HAZ) and a compression stress in the base metal (BM). Increasing the rotational speed reduces the amplitude of the longitudinal residual stresses with a high reduction in the case where AA7075 - T6 is in the advancing side with 1400 rpm. This has been directly associated to the increase in the heat input and the reduction of the thermal mismatch between different areas of the weld. The microstructure effect of aluminum alloy position acts on the acoustoelastic constant K. The choice of  $t_0$  corrects the overestimated residual stresses in the (HAZ) and (N).

**Keywords :** FSW, contraintes résiduelles, microstructure, comportement mécanique, corrélation d'image numérique